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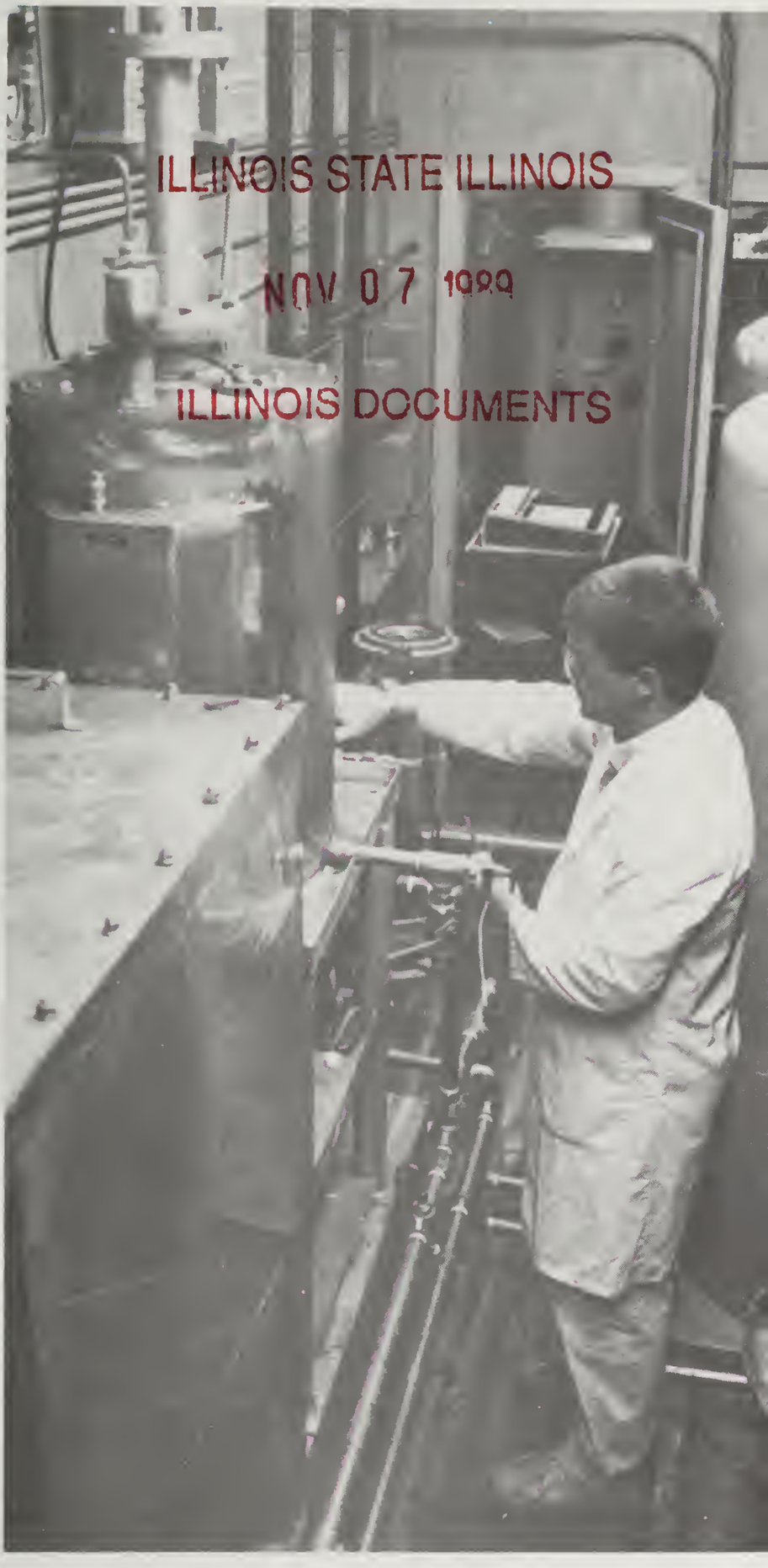
Mobile Oxidation Pilot Plant



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Effective, on-site treatment for industrial wastewater and contaminated ground water

Illinois State Water Survey
Hazardous Waste Research and Information Center
SWS Miscellaneous Publication 114

Over the years, industry and government alike have looked for a safe, convenient, effective method for cleaning toxic wastes. The Illinois State Water Survey can now bring pilot-scale treatment facilities directly to industrial and government field sites with the Mobile Oxidation Pilot Plant (MOPP).

The MOPP is a self-contained, mobile pilot laboratory. It is specially outfitted with state-of-the-art equipment to perform treatment feasibility studies on contaminated ground water and industrial wastewater as they are pumped through the system. Included in the MOPP services are cost estimates and design criteria for the most appropriate and cost-effective full-scale treatment methods.

The treatment processes used in the MOPP convert hazardous organic contaminants, including solvents and pesticides, into harmless products such as carbon dioxide and water. By destroying contaminants at the site of the problem, the treatment eliminates off-site disposal costs, the dangers of transporting toxic chemicals, and long-term environmental and public health liabilities.

Water Treatment Procedures

The MOPP cleans contaminated water by subjecting it to various advanced oxidation processes (AOPs). Advanced oxidation treatments such as ozone in combination with ultraviolet light or peroxide have been known for some time. But until recently these processes have been applied primarily in experimental laboratory settings.

Now the pilot laboratory can be brought to the site of contaminated waste streams and ground water. In the MOPP unit, contaminated water is treated by various AOPs to determine which advanced

oxidation process best solves the problem. Following treatment in the MOPP, the cleaned water is stored in an on-board holding tank, and a sample is analyzed in the MOPP laboratory to determine the efficiency of contaminant removal.

When the MOPP results confirm that the AOP selected is chemically effective, a large volume of water is subjected to the process to determine the applicability of the process to the full-scale cleanup situation. Results of this process are used to estimate the costs of the full-scale project, the facilities necessary, and overall chemical effectiveness at that scale. Thus during one on-site MOPP operation, an AOP treatment is formulated specifically for the contaminated water, the treatment process is tested, and complete estimates for the full-scale cleanup are developed.

Advanced Oxidation Processes

Laboratory testing has shown advanced oxidation processes to be effective for almost all waste streams contaminated with organic compounds. The MOPP is equipped to use various AOPs in order to select the particular water treatment method(s) most effective against the contaminant(s) present. In some cases, an AOP may be combined with other treatments for the most effective results.

Different AOPs use different combinations of ozone gas, hydrogen peroxide, and ultraviolet light to destroy contaminants. In photolytic ozonation, for example, ozone gas is bubbled through a reactor containing the contaminated water. At the same time, ultraviolet light is directed through the water, causing the ozone gas to react photochemically. This reaction leads to the production of hydroxyl radicals that are capable of destroying

practically any organic compound, including most halogenated solvents, aromatic hydrocarbons, PAHs, PCBs, and pesticides.

Chemically, AOP treatment can be compared to controlled combustion, although the MOPP completes the cleanup procedures directly in the water at ambient temperatures. Advanced oxidation treatment is most effective on organic contaminants whose concentrations range from a few micrograms per liter to hundreds of milligrams per liter — just the range at which incineration is impractical.

On-Board Facilities

The MOPP is a fully equipped traveling pilot laboratory housed in a 40-foot, drop-frame moving van. It contains a gas chromatograph and other state-of-the-art instrumentation to treat water and to monitor treatment efficiency.

The MOPP's advanced oxidation facilities include a stirred-tank photochemical reactor and a metering pump for hydrogen peroxide so that all the various AOP combinations can be tested on each given waste stream. Two storage tanks and a system of metering pumps make it possible to conduct the AOP either as a continuous operation on a waste stream or as individual treatments on separate batches of contaminated water.

The mobile unit contains the same research-quality ozone measurement equipment used in the Water Survey's Oxidation Research Laboratory for precise measurement and control of ozone concentrations and flow to the photochemical reactor. Computer-controlled measurement of the ozone consumed during the pilot treatment determines the exact oxidant quantities required for the full-scale operation.

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Using the MOPP at Your Site

Industries that require wastewater treatment and government agencies faced with priority cleanup sites can benefit most from the MOPP. Because the MOPP is a self-contained unit brought to the site, users avoid large capital outlays for development, construction, equipment, and personnel. The Water Survey provides staff, fully equipped facilities, and chemicals — everything necessary to ascertain the precise nature of your water contamination problem and to develop specific treatment plans. The MOPP operator remains on-site throughout the project, and the principal investigator of the MOPP project is available for consultation. Both are analytical chemists.

MOPP analysis and treatment typically begin with preliminary testing in the Water Survey's Oxidation Research Laboratory in Champaign. Preliminary testing normally requires about two weeks, during which time the MOPP unit is relocated to the site, set up, and connected to the waste stream. With preliminary test results in hand, the on-site process can be completed within a few weeks.

During the on-site process, the MOPP operator collects data and completes all necessary analyses using the MOPP's on-board testing facilities, instruments, and computer. Additional support operations are conducted simultaneously by Water Survey scientists at the Oxidation Research Laboratory in Champaign.

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For More Information

For general information about the Mobile Oxidation Pilot Plant and to discuss its availability for water treatment analyses at specific sites, please contact:

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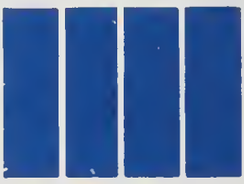

The Illinois State Water Survey is a division of the Illinois Department of Energy and Natural Resources. Water Survey scientists conduct basic and applied research on air and water resource issues from their headquarters on the campus of the University of Illinois at Urbana-Champaign.

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